Patterns and predictors of statin use after coronary artery bypass graft surgery

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Objectives: The benefits of statin therapy for patients with coronary artery disease have been well documented, including those occurring after coronary artery bypass graft surgery. The purposes of this study were to assess statin prescription rates in patients who have undergone coronary artery bypass graft surgery and to identify the determinants of postoperative statin administration.

Methods: A retrospective cohort of 9284 Medicare patients aged 65 years or older who underwent coronary artery bypass graft surgery (1995–2004) was assembled by using linked hospital and pharmacy claims data. Rates of statin use after hospital discharge were calculated, and predictors of postoperative statin use were identified by using generalized estimating equations.

Results: Overall, 35.9% of patients received statins within 90 days of coronary artery bypass graft surgery discharge. Use of statins within 90 days after coronary artery bypass graft surgery steadily improved during the study period, from 13.1% in 1995 to 60.9% in 2004. Patient factors independently associated with an increase in postoperative statin therapy included preoperative statin use (odds ratio, 7.69), later year of operation (odds ratio, 1.22 per additional year), and additional postoperative medications (odds ratio, 1.16 per additional medication). Factors independently associated with a decrease in postoperative statin therapy included peripheral vascular disease (odds ratio, 0.60), diabetes mellitus (odds ratio, 0.67), stroke (odds ratio, 0.77), and older age (odds ratio, 0.96 per additional year). Surgeon and hospital characteristics were not independently associated with postoperative statin use.

Conclusions: Statins are considerably underused after coronary artery bypass graft surgery, although recent prescription rates are increasing. Patterns of use do not appear to correlate with coronary artery disease risk. These findings highlight the need for targeted quality improvement initiatives to increase the rate of statin administration to this at-risk population.

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Although coronary artery bypass graft (CABG) surgery effectively treats ischemic heart disease, the long-term results after CABG surgery are compromised by the progression of atherosclerosis in native coronary arteries and saphenous vein bypass grafts.[1,2] Only 60% of vein grafts remain patent 10 years after surgical intervention, and 50% of those that are patent have clinically important stenosis.[1,2] Accordingly, patients after CABG surgery are at high risk for subsequent ischemic events, including death, myocardial infarction, and stroke.[1,2]

Clinical trials have consistently demonstrated that statins reduce the risk of recurrent cardiovascular events and improve survival in patients with coronary artery disease (CAD), including survival in patients after CABG surgery.[3-5] In the largest study involving patients after surgical revascularization, treatment with 40 to 80 mg of lovastatin daily reduced low-density lipoprotein (LDL) cholesterol levels to less than

Abbreviations and Acronyms

CABG = coronary artery bypass grafting
CAD = coronary artery disease
CI = confidence interval
GEE = generalized estimating equation
LDL = low-density lipoprotein
OR = odds ratio
PAAD = New Jersey Pharmaceutical Assistance to the Aged and Disabled
PACE = Pennsylvania Pharmaceutical Assistance Contract for the Elderly

100 mg/dL and significantly reduced the progression of postoperative vein graft disease compared with moderate cholesterol treatment with 2.5 to 5 mg of lovastatin daily.[5]

The American Heart Association/American College of Cardiology Secondary Prevention Clinical Guidelines[6] and the National Cholesterol Education Program Adult Treatment Panel III Guidelines[7,8] currently recommend treatment to achieve LDL levels of less than 100 mg/dL for patients with documented atherosclerotic vascular disease, including patients after CABG surgery. Because less than 7% of patients with atherosclerosis are able to achieve LDL levels of less than 100 mg/dL with diet and exercise regimens[9,10] in the absence of severe contraindications, essentially all patients after CABG surgery are candidates for long-term postoperative statin therapy.[11] Whether patients undergoing CABG surgery actually receive statins after the operation is largely unknown. Therefore we sought to assess the rate of statin use among patients discharged from the hospital after CABG surgery and to identify the determinants of statin use in this population.

Materials and Methods

Setting and Design

We assembled a retrospective cohort of Medicare patients who underwent CABG surgery by linking Medicare files to data from the Pennsylvania Pharmaceutical Assistance Contract for the Elderly (PACE) and the New Jersey Pharmaceutical Assistance to the Aged and Disabled (PAAD) programs. Both PACE and PAAD provide prescription drug benefits to lower middle-income individuals aged 65 years or older whose yearly earnings are above the threshold to qualify them for Medicaid. Participants pay copayments of between $5 and $10 per prescription without any deductibles. The programs cover all medications that require a prescription and do not restrict which medications can be prescribed (ie, the programs do not use formularies, preferred drug lists, or prior authorization programs).

Data from PACE, PAAD, and Medicare were incorporated into a relational database consisting of data for all filled prescriptions, procedures, physician encounters, hospitalizations, long-term care admissions, and deaths for the patients in this cohort. These data sources have been used extensively to study population-based health outcomes.[12,13] All traceable person-specific identifying factors were transformed into anonymous, coded study numbers to protect subjects' privacy. This study was approved by the institutional review board of the Brigham and Women's Hospital.

Cohort

We included patients who were discharged from the hospital after undergoing CABG surgery (International Classification of Diseases–Ninth Revision 36.1x or 36.2x) between January 1, 1995, and December 31, 2004. We excluded patients who died within 90 days after surgical intervention, patients who were not active users of either drug benefit program, and patients who received prescriptions for cerivastatin since this drug was withdrawn from the market. The date of discharge from the hospital after CABG was considered as the index date for the study analysis.

Statin Use

We assessed statin prescription rates (ie, prescriptions that were filled) in the 1-year period before CABG surgery, as well as within 90 days, 180 days, and 365 days after the CABG discharge date. Patients were classified into drug and dose categories based on their statin prescription data before and after surgical intervention. "High-intensity statins" were those that would be expected to decrease LDL cholesterol levels by greater than 40% (atorvastatin, >10 mg; lovastatin, >40 mg; rosuvastatin, >5 mg; simvastatin, >40 mg). All other statin drug-dose combinations were considered "low-intensity statins" (atorvastatin, ≤10 mg; lovastatin, ≤40 mg; rosuvastatin, ≤5 mg; simvastatin, '40 mg; any dose of fluvastatin; any dose of pravastatin).[8,14]

Patient Covariates

We determined patient comorbidities by searching physician service claims and hospitalization records for relevant diagnostic codes in the 1-year period before the index date. In this manner the following characteristics were identified: age at index date, year of operation, sex, race, length of hospital stay, previous myocardial infarction or acute coronary syndrome, hypertension, diabetes mellitus, congestive heart failure, stroke, peripheral vascular disease, previous CABG surgery, previous percutaneous coronary intervention, chronic kidney disease, and chronic obstructive pulmonary disease. We also determined the use of the following concurrent medications in the 1-year period before and 90 days after CABG surgery: angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers, β-blockers, calcium-channel blockers, fibrates, diuretics, nitrates, digoxin, warfarin, and clopidogrel.

Hospital and Surgeon Covariates

We identified the hospital and surgeon for each CABG procedure. Hospitals that were accredited with the Association of American Medical Colleges were classified as teaching hospitals. All other hospitals were classified as nonteaching hospitals. We classified the "operating surgeon" as the cardiac, cardiothoracic, or thoracic surgeon who submitted a claim for CABG on the date of surgical intervention using Medicare Part B claims. Records containing invalid provider identification numbers were excluded from further analysis. If 2 or more surgeons were identified for an individual patient, then we defined the most responsible surgeon as the

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